

Appl. No. 10/087,040
Amdt. dated March 16, 2004
Reply to Office Action of December 17, 2003

PATENT

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

- 1-2. (Canceled)
3. (Amended) An electro-mechanical system capable of overcoming stiction forces through localized vibration, the system comprising:
 - a base layer having a surface;
 - a device supported above the surface by a pivot, wherein the device is movable along a movement path;
 - a stop located at a contact position along the movement path, wherein the device contacts the stop at the contact position, and wherein a stiction force between the device and the stop exists at the contact position; and
 - a vibration element operable to cause a vibration at or near the contact position, the vibration element having a vibration actuator, wherein the vibration disrupts the stiction force.
4. (Original) The system of claim 3, the system further comprising an device actuator, wherein the device actuator is operable to cause the device to move along the movement path.
5. (Original) The system of claim 3, wherein the device is a structural plate, comprising a micro mirror.
6. (Original) The system of claim 3, wherein the stop comprises an area of the base layer.
7. (Original) The system of claim 6, wherein the vibration element is a mechanical structure operable to repeatedly contact the device at or near the contact point.

Appl. No. 10/087,040

PATENT

Amtdt. dated March 16, 2004

Reply to Office Action of December 17, 2003

8. (Amended) The system of claim 3, wherein the vibration element comprises a device actuator, wherein the device actuator is operable to cause the device to move relative along the movement path.

9. (Original) The system of claim 3, wherein the vibration element is integral to the device.

10. (Original) The system of claim 3, wherein the device is a first device, the pivot is a first pivot, the stop is a first stop, the contact position is a first contact position, the movement path is a first movement path, and the vibration device is a first vibration device, the system further comprising:

at least a second device and a second pivot, wherein the second device is supported above the surface by the second pivot, and wherein the second device is movable along a second movement path;

at least a second stop located at a second contact position along the second movement path, wherein the second device contacts the second stop at the second contact position, and wherein the contact between the second device and the second stop is susceptible to a stiction force;

at least a second vibration element operable to cause a vibration at or near the second contact position, wherein the vibration disrupts the stiction force; and

wherein the first and second vibration elements are electrically connected such that the first and second vibration elements are activated together.

11-91. (Canceled)

92. (New) The system of claim 3, wherein the vibration element comprises an actuator and the device comprises a structural plate and wherein the actuator is activated by a force that creates a movement of the stop relative to the structural plate, wherein the movement is sufficient to overcome stiction forces between the structural plate and the stop.

Appl. No. 10/087,040

Amdt. dated March 16, 2004

Reply to Office Action of December 17, 2003

PATENT

93. (New) The system of claim 92, wherein activating the actuator with a force causes the stop to displace from a static position to a displaced position, and wherein the movement results from elastic forces associated with the stop which cause the stop to displace from the displaced position to the static position when the actuator is de-activated.

94. (New) The system of claim 93, wherein the movement comprises an oscillation of the stop.

95. (New) The system of claim 94, wherein the oscillation comprises displacement of the stop from the displaced position passed the static position to an overshoot position and back to the static position.

96. (New) The system of claim 92, wherein the structural plate is supported above the base layer by a pivot and the stop is disposed over the base layer.

97. (New) The system of claim 96, the system further comprising a micro-mirror disposed on the structural plate.

98. (New) The system of claim 96, wherein the actuator is a first actuator, the system further comprising a second actuator, wherein application of a DC voltage to the second actuator cause the structural plate to displace and contact the stop.

99. (New) The system of claim 3, wherein the stop comprises a mechanical stop, the device comprises a structural plate, and the vibration element comprises an actuator, and wherein application of a DC voltage to the actuator causes the mechanical stop to move relative to the structural plate from a static position to a displaced position, and wherein removal of the DC voltage causes a movement of the mechanical stop from the displaced position to the static position, and wherein the movement is sufficient to overcome stiction forces between the structural plate and the mechanical stop.

100. (New) The system of claim 99, wherein the movement comprises an oscillation of the mechanical stop.

Appl. No. 10/087,040

PATENT

Amdt. dated March 16, 2004

Reply to Office Action of December 17, 2003

101. (New) The system of claim 100, wherein the oscillation comprises displacement of the mechanical stop from the displaced position passed the static position to an overshoot position and back to the static position.

102. (New) The system of claim 99, wherein the structural plate is supported above base layer by a pivot and the mechanical stop is disposed over the base layer.

103. (New) The system of claim 102, wherein the actuator is a first actuator, the system further comprising a second actuator, wherein application of a force to the second actuator causes the structural plate to deflect into contact with the mechanical stop.

104. (New) The system of claim 99, wherein the system comprises an optical routing apparatus comprising a moveable micro-mirror.

105. (New) The system of claim 3, wherein the vibration element comprises an actuator and the device comprises a structural plate, and wherein the actuator is activated by an alternating force that creates an oscillating movement of the stop relative to the structural plate, wherein the oscillating movement is sufficient to overcome stiction forces between the structural plate and the stop.

106. (New) The system of claim 105, wherein the alternating force is an AC voltage or a pulsed DC voltage.

107. (New) The system of claim 105, wherein activating the actuator with an alternating force causes the stop to displace to a displaced position when the alternating force is at a first potential, and wherein an elastic force associated with the stop causes the stop to displace toward a static position when the alternating force is at a second potential.

108. (New) The system of claim 107, wherein the oscillating movement results from displacing the stop to the displaced position and returning the stop toward the static position.

Appl. No. 10/087,040

Amdt. dated March 16, 2004

Reply to Office Action of December 17, 2003

PATENT

109. (New) The system of claim 108, wherein the oscillating movement oscillates at a frequency at or about the frequency of the alternating force.

110. (New) The system of claim 105, wherein the structural plate is supported above the base layer by a pivot and the stop is disposed over the base layer.

111. (New) The system of claim 110, wherein the actuator is a first actuator, the system further comprising a second actuator, wherein application of a voltage to the second actuator cause the structural plate to displace and contact the stop.